NATIONAL SCIENCE FOUNDATION
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ARLINGTON, VIRGINIA 22230

NSF 15-120

Dear Colleague Letter: Supporting Research Advances in Smart and Connected Communities

September 14, 2015

Dear Colleagues:

The National Science Foundation's (NSF) Directorates for Computer and Information Science and Engineering (CISE), Education and Human Resources (EHR), Engineering (ENG), Geosciences (GEO), and Social, Behavioral and Economic Sciences (SBE) wish to notify the community of their intention to support, foster, and accelerate fundamental research that addresses challenges in enabling Smart and Connected Communities (S&CC).

Advances in the effective integration of networked information systems, sensing and communication devices, data sources, decision making, and physical infrastructure are transforming society, allowing cities and communities to surmount deeply interlocking physical, social, behavioral, economic, and infrastructural challenges. These novel sociotechnical approaches enable increased understanding of how to intelligently and effectively design, adapt, and manage Smart and Connected Communities. **Through this Dear Colleague Letter (DCL), NSF aims to accelerate fundamental understanding and stimulate basic research on frameworks that integrate and operate on data from multiple sources and at multiple temporal and spatial scales, new sociotechnical systems that are interconnected and interdependent, and new technologies for innovative applications and services to enable more livable, workable, sustainable, and connected communities.** Beyond supporting isolated efforts deemed as "islands of successes," NSF seeks to develop the scientific and engineering foundation and underlying environment that enables and spurs innovations of technologies and systems that can be integrated into the overall S&CC vision.

A successful Smart and Connected Communities solution demands demonstration of marked improvement (quantifiable evidence) of the stakeholder experience – whether in personal quality of life, community and environmental health, social well-being, educational achievement, or overall economic growth and stability. Toward developing successful S&CC solutions, researchers must engage industry and non-profit partners, state and local government officials, technology developers, and end users throughout the process â€" from conceptualization to implementation. Since S&CC involve K-16 education institutions and informal education resources such as media and museums, research projects that explore linkages to these institutions are encouraged. In other words, researchers should pursue the "living lab" approach where research and development is staged with pilot deployments within communities. This approach leads to quantifiable improvements that demonstrate feasibility of concepts as well as provide evidence for broad adoption.

The interactions and interdependence of systems in different domains (e.g., energy, transportation, environment, and public health) are becoming increasingly important in today's connected communities. Overcoming challenges to Smart and Connected Communities therefore requires a systems approach to

understand how a system's constituent parts are interrelated and function over time within the context of the larger, evolving system, which in turn necessitates integration of advances and results in multiple research and application domains. Successful applications of these complex systems will require the development, testing, and deployment of models of education and training that rest upon research about how people learn, and how transdisciplinary and trans-community teams form and succeed. Furthermore, the role of humans as users and as part of the system is central in S&CC, and proposals must include social, behavioral, and economic components or integrate social, behavioral, and economic perspectives.

With this DCL, NSF invites supplements to existing CISE, EHR, ENG, GEO, and SBE grants, or new EArly-concept Grants for Exploratory Research (EAGER) proposals submitted to the CISE, EHR, ENG, GEO, and/or SBE directorates. Supplemental proposals must enhance existing projects by incorporating or exploring the concepts described in this DCL, while demonstrating how the proposed work is related to the active project. Any proposal must describe how the research and activities fit within the Smart and Connected Communities vision. These descriptions must include the practical challenges being addressed, i.e., the proposed work should advance science, be motivated by a real-world challenge, and lead to a solution that can be adopted by a community or municipality. EAGER proposals must pursue "high-risk, high-reward" research and activities, in the sense that they involve radically different approaches, apply new expertise, or engage novel disciplinary or interdisciplinary perspectives. They must address concepts described in this DCL by demonstrating how the high-risk, high-reward research and activities fit within the S&CC vision.

For example, in a supplemental request, a project focusing on transportation management may propose to add a component to work with a local transportation agency to implement a pilot deployment of technologies for inferring and predicting a transit system's state by considering its riders as human sensors; or a project focused on privacy in the smart energy grid may propose to add a component to work with industry and community partners to implement a pilot deployment of privacy protection mechanisms. In addition, proposed supplements may provide an opportunity to broaden the project's interdisciplinary dimensions to incorporate other sociotechnical disciplines and perspectives of relevance. Supplements that aim to foster and strengthen interaction among researchers, educators, technology developers, and community stakeholders, to advance research or education in the S&CC vision, across disciplinary, organizational, geographic, and international boundaries, will also be considered. Similarly, in an EAGER proposal, the integration of basic science with S&CC challenges and anticipated solutions must be described. All proposals must, to the extent possible, go beyond qualitative assessments and describe how the potential impacts of their approaches and solutions will be quantified. Supplements or EAGERs that link S&CC concepts to learning in formal or informal settings, including innovations that involve citizen science or maker projects, are encouraged – particularly projects that involve or benefit underrepresented groups.

Supplemental and EAGER proposals that fail to address concepts described in this DCL will be returned without review. A principal investigator may submit at most one supplemental or EAGER proposal pursuant to this DCL.

The deadline for submission of supplemental requests is March 1, 2016, but earlier submissions are encouraged. Submissions should follow the NSF's Grant Proposal Guide (GPG), including GPG Section II.D.2 for EAGER proposals (see http://www.nsf.gov/publications/pub_summ.jsp?ods_key=gpg).

Principal investigators interested in submitting supplemental or EAGER proposals (or with other questions pertaining to this DCL) must first contact the program director most closely aligned with the research activities to be proposed:

- David Corman, CISE/CNS, Program Director for Cyber-Physical Systems, at dcorman@nsf.gov;

Wendy Nilsen, CISE/IIS, Program Director for Smart and Connected Health, at wnilsen@nsf.gov;
- Sushil Prasad, CISE/ACI Program Director for Learning and Workforce Development, at sprasad@nsf.gov;
- Rahul Shah, CISE/CCF Program Director for Algorithmic Foundations, at rshah@nsf.gov;
- Laura Stanley, CISE/IIS, Program Director for Cyber-Human Systems, at lstanley@nsf.gov;
- Taylor Martin, EHR/DRL, Program Director for Critical Techniques and Technologies for Advancing Foundations and Applications of Big Data Science & Engineering (BIGDATA), at htmartin@nsf.gov;
- Radhakisan Baheti, ENG/ECCS, Program Director for Energy, Power, Control, and Networks, at rbaheti@nsf.gov;
- Bruce Hamilton, ENG/CBET, Program Director for Environmental Sustainability, at bhamilto@nsf.gov;
- Elise Miller-Hooks, ENG/CMMI, Program Director for Civil Infrastructure Systems, at elisemh@nsf.gov;
- Massimo Ruzzene, ENG/CMMI, Program Director for Dynamics Control and Systems Diagnostics, at mruzzene@nsf.gov;
- Chengshan Xiao, ENG/ECCS, Program Director for Communications, Circuits and Sensing Systems, at cxiao@nsf.gov;
- Nicholas Anderson, GEO/AGS, Assistant Program Director for Major Research Instrumentation, at nanderso@nsf.gov; and/or
- Heng Xu, SBE/SES, Program Director for Secure and Trustworthy Cyberspace, Critical Techniques and Technologies for Advancing Foundations and Applications of Big Data Science & Engineering, and Resource Implementations for Data Intensive Research in the Social, Behavioral and Economic Sciences, at hxu@nsf.gov.

Sincerely,

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